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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/602,291

06/24/2003

Elizabeth A. Dauch

NEC0252US

1241

33031

7590

10/18/2004

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EXAMINER

GURLEY, LYNNE ANN

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 10/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/602,291

Applicant(s)

DAUCH ET AL.

Examiner

Lynne A. Gurley

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 August 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.


LYNNE A. GURLEY

PRIMARY PATENT EXAMINER

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.

- 4) ☐ Interview Summary (PTO-2300, AU 2812)
Paper No(s)/Mail Date: _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the amendment with remarks, filed 8/2/04.

Currently, claims 1-9 are pending. Claims 10-26 have been canceled in the amendment, filed 8/2/04.

Specification

1. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mautz et al. (US 5,476,816, dated 12/19/95) in view of Tsai et al. (US 6,410,417, dated 6/25/02).

Mautz shows the method as claimed in Figures 3-6 and corresponding text as: forming a tungsten plug 32/31 in a dielectric layer 28; forming an electrically conductive interconnect line 41 on the dielectric layer after formation of the tungsten plug, wherein the tungsten plug is electrically connected to the electrically conductive interconnect line; contacting the electrically conductive interconnect line with liquid water after formation of the electrically conductive interconnect line; contacting the electrically conductive interconnect line with a solution after the electrically conductive interconnect line is contacted with the liquid water (column 6, lines 25-30, lines 45-62; column 7, lines 1-16); wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes (claim 1; column 4, lines 2-27; column 5, lines 30-35, lines 53-56; column 6, lines 2-4, lines 28-29, lines 45-61; column 7, lines 2-17). The liquid water is deionized and degasified, and may contact the interconnect for 60-120 seconds or 45-120 seconds or 1-10 minutes (claims 1-2, and 7-8). The claimed interconnect

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materials are used (claim 9; column 4, lines 8-27). Liquid water inherently has a pH equal to 7, which is neutral (claim 6).

Mautz lacks anticipation only in not teaching, or explicitly teaching that: 1) the solution contacting the electrically conductive interconnect line removes residual polymer; 2) the liquid water is deionized but not degasified; 3) the liquid water is degasified but not deionized; and, 4) the liquid water is neither degasified nor deionized.

Tsai teaches, in figs. 1-4 and corresponding text, a similar tungsten plug and subsequent interconnect formation method. Emphasis is placed on the fact that Tsai teaches conventional processing for tungsten plug and interconnect devices and, the results of the processing steps, wherein after patterning the metal interconnect over the via plugs, the photoresist is removed by ashing, which often leaves a polymer residue on the surface of the wafer to be subsequently removed by a wet stripper (i.e., a solvent, alkaline, etc.) (column 1, lines 34-60). In addition to the polymer residue, the ashing process additionally results in an increase in the charge on the wafer (column 1, lines 45-48). The photoresist is removed by ashing with oxygen plasma and water vapor or water plasma, after patterning the interconnect. The water vapor or water plasma is used to reduce the amount of wafer charging and to protect the tungsten from erosion in case of misalignment as seen in fig. 4 (column 2, lines 1-10 and lines 50-61; column 3, lines 10-35).

It would have been obvious to one of ordinary skill in the art to have incorporated, in the method of Mautz, a solution contacting the electrically conductive interconnect line to remove residual polymer, as taught in the method of Tsai, with the motivation that Tsai teaches that the solution removes the polymer residue resulting from a conventional resist ashing process, such as the conventional ashing process shown in Mautz. Additionally, one of ordinary skill in the art

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would find motivation to incorporate the polymer removing solution, taught in Tsai, within the framework of the liquid water and solution exposure steps in Mautz, since Mautz teaches that liquid water rinsing is performed before the exposure of the substrate to a solution which removes contaminants such as mobile ions on the substrate (column 4, lines 66-67; column 5, lines 1-3 and lines 23-67; column 6, lines 1-3). The residual polymer is considered to one of ordinary skill in the art to be a form of contaminant and, the solvent, which Mautz uses, removes the contaminants and contains alcohols (column 5, lines 40-51) which are naturally basic and alkaline, such as the polymer removing solution exemplified in Tsai. In general, Tsai makes it clear that the polymer removal step is necessary as a separate step from the ashing step (column 3, lines 40-43). The ashing step is used to reduce the charge on the wafer in Tsai, just as the solvent exposure, in the wafer cleaning step, is used in part to reduce the wafer charge in Mautz. The two processes are compatible because they both seek to reduce the wafer charge in similar tungsten plug/interconnect processes and taken as a whole, both teach and acknowledge that solutions used after the ashing process are necessary to clean the substrate of contaminants, to remove charges on the wafer and to remove residual polymer. To further add a step to the process of Mautz to remove the polymer residue after the ashing step would be obvious in addition to removing the harmful charge on the wafer.

It would have also been obvious to one of ordinary skill in the art to have modified the properties of the water in the method of Mautz, pertaining to ionization and degasification, with consideration for possible tungsten erosion and misalignment as taught by Tsai and, with the motivation that changing these parameters would offer additional control in the amount of

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charged particles desired on the surface of the interconnect, especially since Tsai teaches that the water vapor or water plasma is useful for decreasing the wafer charge due to the ashing step.

Response to Arguments

6. Applicant's arguments with respect to claims 1-9 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

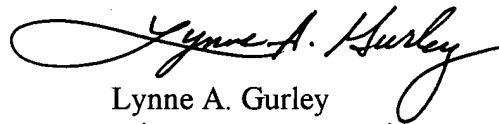
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is 571-272-1670. The examiner can normally be reached on M-F 7:30-4:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 571-272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Lynne A. Gurley
Primary Patent Examiner
TC 2800, AU 2812

LAG
October 14, 2004